Medicine in Old Age

Accidental Hypothermia

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It is generally considered that a hypothermic state exists when the *deep* body temperature falls below an arbitrarily defined limit of 35°C (or 95°F). The term accidental hypothermia is used to imply that the lowering of the body temperature is unintentional and it has to be distinguished from hypothermia induced for the purposes of medical or surgical treatment.

Incidence

The British Medical Association Committee on Accidental Hypothermia in the Elderly,[1] after reviewing the descriptions of cases published in Britain up to the early 1960s, concluded that there was no accurate information on the incidence of the condition. The hospital reports indicated that very few cases were recognized before admission and elderly people with hypothermia suffered a high mortality. Death resulted from the often serious nature of the underlying disease as well as from the effects of hypothermia itself.

The Registrar General's returns of death certificates indicate that only about 100 fatal cases are reported annually.[2] These figures are at variance with those reported in the survey conducted by the Royal College of Physicians.[3] Ten hospital groups co-operated in the investigation and during the three months 1 February to 30 April 1965 it was found that 126 patients had rectal temperatures of 35°C or less on admission, representing 0·68% of all admissions. It was estimated that there could have been 9,000 patients admitted to hospitals in England and Wales with hypothermia during the three winter months, and 42% of these patients were over the age of 65. The true incidence is probably much higher than this, especially among the elderly, since the survey did not include those patients treated at home in many of whom hypothermia passes unrecognized.

Relation Between Body Temperature and Environmental Conditions

The results of the first large-scale national survey of body temperatures of old people in Great Britain living at home were reported by Fox and his colleagues in 1973.[2] The investigation was based on measurements made on 1,020 people of 65 years and over during the first three months of 1972. In 754 cases (75%) the room temperatures of the old people were at or below 18·3°C (65°F)—the minimum recommended by the Parker Morris report on council housing—and in 10% the morning living-room temperatures were very cold, at or below 12·0°C. The deep body temperatures in the morning and evening were measured by the Uritemp technique.[4] In about 10% of subjects the deep body temperatures were below 35·5°C ("low" group) and these were considered to be at risk of developing hypothermia. In comparison with a "normal" group (36·0°C and above), not only were they less successful in conserving body heat—as shown by their inability to maintain an adequate core/shell temperature gradient—but they also had a proportionately lower body heat content. The high prevalence of low room temperatures and of low body temperatures in the morning clearly indicated the need for measures to protect the individual from cold exposure at night. Disturbingly many individuals whose temperatures were in the "low" group were already receiving supplementary benefits, and yet only 3% of these pensioners were receiving an extra fuel allowance.

Aetiology

The main causes of accidental hypothermia may be grouped under two headings:

EXOGENOUS FACTORS

Exposure to cold is an over-riding cause, and there is a clear relation between the incidence of accidental hypothermia and a low environmental temperature. A common story is of an old person who falls after attempting to get out of bed at night; he remains on the floor for several hours, often partly clad, and is discovered only the next day by a neighbour or a home help. Thus probably the exposure is longer when the old person lives alone and is socially isolated. Very many cases, however, occur with lesser degrees of exposure, while the old person is in bed at night apparently well covered. In these instances insufficient body heat is being generated, so that even good external insulation is ineffective.

ENDOGENOUS FACTORS

Some degree of thermoregulatory failure is common in old age and the mechanisms for conserving body heat are impaired. Experiments on individual volunteers often show a poor shivering reaction in response to cold; while their deep body temperature is falling, older people are unaware of the cold exposure and do not complain of cold. Drugs acting on the nervous system can further impair physiological mechanisms. Thus chlorpromazine and other phenothiazines not only affect temperature regulation by abolishing shivering and causing vasodilatation, but they also lessen the patient's awareness of environmental hazards. The ingestion of alcohol, and a variety of sedatives, tranquillizers, and antidepressive drugs have all caused accidental hypothermia.

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In addition to this impairment of temperature homoeostasis most severe examples of hypothermia in patients admitted to hospital have some underlying clinical condition. Almost any serious disorder may cause hypothermia but those commonly found are:

(1) Endocrine disorders: myxoedema and hypopituitarism in which the metabolic rate is lowered.

(2) Neurological disorders: especially cerebrovascular accident, which may not only be responsible for the initial fall causing exposure but, owing to the paralysis, for limiting the heat generated by muscular activity.

(3) Conditions associated with immobility—for example, stupor or coma from various causes, Parkinsonism, paraplegia, and chronic arthritis. These patients are often confined to bed and the lack of muscular activity leads to inadequate heat production.

(4) Mental impairment and confusional states: if such patients are not receiving sufficient supervision they may be unable to protect themselves from cold exposure.

(5) Severe infections and circulatory disturbances—for example, bronchopneumonia, cardiac infarction, and pulmonary embolism.

Thus a variety of acute and chronic conditions may be responsible, and in most cases of accidental hypothermia in the elderly both exogenous and endogenous factors operate in varying proportions.

Clinical Features

A description of the clinical features is given in the reports of a series of cases treated in hospital by Duguid and her colleagues[5] and by Rosin and Exton-Smith.[6]

APPEARANCE

The intense peripheral vasoconstriction leads to pallor of the skin, and when cyanosis is also present the patient has a pallid grey colour. There is puffiness of the face and this together with the slow cerebration and the husky voice may be thought to be due to myxoedema.

NERVOUS SYSTEM

As the body temperature falls below 32°C clouding of consciousness, progressive confusion, and drowsiness develop. The patient's responses are slow and the reflexes are sluggish. Shivering is absent and below about 30°C it is replaced by a muscular hypertonus. This may lead to neck stiffness simulating meningism and to rigidity of the limbs. An involuntary flapping tremor in the arms and legs has been observed in some cases.[6]

RESPIRATORY SYSTEM

The respirations are slow and shallow. An appreciable fall in arterial oxygen saturation may occur as the result of this hypopnoea; the effect of anoxia on the tissue metabolism is one of the factors determining prognosis. Bronchopneumonia is nearly always present, but it may not be detected owing to the absence of the usual clinical signs.

CARDIOVASCULAR SYSTEM

In response to cold the heart rate slows due to sinus bradycardia or to slow atrial fibrillation. In the early stages the blood pressure is maintained but a fall in blood pressure in spite of the intense peripheral vasoconstriction is a bad prognostic sign. The electrocardiogram often shows some degree of heart block with lengthening of the PR interval and delay in intraventricular conduction. A pathognomonic sign is the appearance of a "J" wave with a characteristic deflection at the junction of the QRS and ST segments. These waves, which are usually best seen in V4, occur only in about a third of cases.

ALIMENTARY SYSTEM

Post-mortem examination often shows acute pancreatitis, but the clinical diagnosis is rarely made. The clouding of consciousness and the muscular rigidity of the abdominal wall due to hypothermia obscure the usual signs, but pancreatitis should be suspected if the patient is seen to wince when firm pressure is applied to the epigastrium. The serum amylase is raised in most severe cases of hypothermia.

Management

Patients with mild degrees of hypothermia (with a temperature just below 35°C) can sometimes be treated at home. The adverse social circumstances which led to the hypothermia often preclude home treatment, even in these less serious cases. When the deep body temperature is less than 32°C urgent admission is required since treatment can only be given in hospital.

There has for long been controversy about the best way of restoring normal body temperature. The dangers of rapid rewarming, which may cause circulatory collapse and an "after-drop" of the deep body temperature, are well known. It is therefore often advocated that there should be no active rewarming at all, the patient being lightly covered in a ward at an ambient temperature of 21°C and his temperature allowed to come up very slowly. The disadvantage of this method is that when there has already been long exposure to cold at home the period of hypothermia is greatly prolonged and irreversible changes in the tissues may take place. The incidence of complications and the late mortality are related to the duration of the hypothermia. There is need for further investigation of methods of rewarming, but the assessment of results using different methods of treatment is made difficult because prognosis is determined by the nature of the underlying disease as well as by the severity of hypothermia. It is now believed, however, that better results can be obtained by more rapid rewarming provided the patient is treated in an intensive care unit.

Most patients with severe hypothermia will require the following measures: (1) the administration of oxygen and the institution of intermittent positive pressure ventilation; (2) the insertion of a central venous catheter for the measurement of pressure and the administration of warm fluids; (3) the correction of dehydration and of metabolic acidosis; (4) the intravenous administration of hydrocortisone and a broad-spectrum antibiotic, which is given because bronchopneumonia often develops insidiously; and (5) the continuous or frequent monitoring of deep body temperature.

When accidental hypothermia is associated with barbiturate overdosage, peritoneal dialysis has been used successfully with the dual purpose of removing barbiturate from the blood stream and for rewarming the large vascular areas and organs of the abdomen. Only if there is a strong suspicion from the clinical history or laboratory evidence that the hypothermia is due to myxoedema should tri-iodothyronine be given. The dose used is small (10 μg eight to twelve hourly) since in high dosage myocardial infarction may be precipitated.

Preventive Measures

RECOGNITION OF OLD PEOPLE AT RISK

Doctors and community nurses should pay particular attention to old people living in cold accommodation even though they

say they do not feel the cold. The regular recording of deep body temperature either by means of a low-reading rectal thermometer or by the Uritemp technique, especially in those whose activities are restricted by chronic illness or disability, would be valuable. The Health Departments of some local authorities operate visiting schemes for those most at risk including the over 75s, those living alone (and very elderly couples living by themselves), the housebound, and the handicapped. Social workers can detect many unmet needs in isolated old people and they should be aware of the circumstances which lead to accidental hypothermia.

HEATING

So far as possible elderly people should be encouraged to install in their homes safe means of heating—for example, electric convector heaters and night storage heaters. The heating of the bedroom is just as important as that of the sitting room. In severe weather when it may be impossible to keep more than one room warm it is preferable to have adequate heat in the living room and to make up the bed in it. Since many old people in receipt of supplementary benefits are not receiving an extra fuel allowance (largely because they do not know about it), wider publicity needs to be given to the availability of extra heating allowances (see Department of Health and Social Security, *Provision for Heating, 1972.*[7])

CLOTHING AND BLANKETS

Old people are sometimes found to be wearing unsuitable clothing, such as several felted woollen garments. For maximum comfort and warmth they should be advised that clothing needs to be light, closely woven, and not restricting. Similar comments also apply to bed clothes. Since many elderly people develop hypothermia at night, the protection against exposure to cold while they are in bed is important. Although there may be some resistance to the use of a new appliance an electric overblanket is very helpful. The conventional electric underblanket should not be used because of hazards in incontinent patients. A low-voltage, low-wattage underblanket which is waterproof is being developed and this is proving to be an effective means of keeping old people warmer in bed.

NUTRITION

Many of the factors which make a person at risk of developing hypothermia also lead to malnutrition, so the two conditions are sometimes found together. The cost of extra fuel in winter may leave much less money to be spent on food. Many pensioners live on the borderline of malnutrition, and inadequate nutrition may occur just at the time when the energy needs of the body are greatest. It should be remembered, however, that it is not necessarily the thin, seemingly undernourished old people who are predisposed to hypothermia since they are more likely to be active; it can occur in the obese inactive old person. In spite of the feeling of warmth which alcohol gives, old people should be warned that it increases heat loss from the body and is conducive to hypothermia. In winter there is a need for the general practitioner and health visitor to pay particular attention to the adequacy and nutrient content of the diet of old people.

Conclusion

For the diagnosis of accidental hypothermia the deep body temperature must be measured either by means of a rectal thermometer or by the Uritemp technique. The much wider use of low-reading thermometers by doctors and the community nursing services is essential, and there must be much greater awareness of the vulnerable groups in the elderly population. The early detection of accidental hypothermia in old people living at home and treatment before profound hypothermia has developed would seem to be the best means of reducing the mortality.

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